

01-03-00

A

Please type a plus sign (+) inside this box [+]

PTO/SB/05 (12/97)

Approved for use through 09/30/00. OMB 0651-0032

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 42390.P7301Total Pages 3First Named Inventor or Application Identifier James L. LansfordExpress Mail Label No. EL 431 890 118 US

ADDRESS TO: Assistant Commissioner for Patents
 Box Patent Application
 Washington, D. C. 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. X Specification (Total Pages 20)
(preferred arrangement set forth below)
 - Descriptive Title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claims
 - Abstract of the Disclosure
3. X Drawings(s) (35 USC 113) (Total Sheets 3)
4. X Oath or Declaration (Total Pages 4)
 - a. X Newly Executed (Original or Copy)
 - b. Copy from a Prior Application (37 CFR 1.63(d))
(for Continuation/Divisional with Box 17 completed) (**Note Box 5 below**)
 - i. DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. Microfiche Computer Program (Appendix)
7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. Computer Readable Copy
 - b. Paper Copy (identical to computer copy)
 - c. Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & documents(s))
9. ☐ a. 37 CFR 3.73(b) Statement (where there is an assignee)
☐ b. Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ a. Information Disclosure Statement (IDS)/PTO-1449
☐ b. Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. ☐ a. Small Entity Statement(s)
☐ b. Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Other: Copy of postcard with Express Mail Certificate of Mailing

17. If a **CONTINUING APPLICATION**, check appropriate box and supply the requisite information:
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)
of prior application No: _____

18. Correspondence Address

☐ Customer Number or Bar Code Label _____
(Insert Customer No. or Attach Bar Code Label here)

or

☒ Correspondence Address Below

NAME David Kaplan

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

ADDRESS 12400 Wilshire Boulevard

Seventh Floor

CITY Los Angeles STATE California ZIP CODE 90025-1026

Country U.S.A. TELEPHONE (408) 720-8598 FAX (408) 720-9397

UNITED STATES PATENT APPLICATION

FOR

**METHOD AND APPARATUS FOR WIRELESS
COMMUNICATION BETWEEN ELECTRONIC DEVICES**

Inventors:

James L. Lansford
Jon W. T. Inouye
Debashis Chowdhury

Prepared by:

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP
12400 Wilshire Boulevard
Los Angeles, CA 90025-1026

Attorney Docket No.: 42390.P7301

"Express Mail" mailing label number: EL 431 890 118 US

Date of Deposit: December 29, 1999

I hereby certify that I am causing this paper or fee to be deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated above and that this paper or fee is addressed to the Assistant Commissioner for Patents, Washington D.C. 20231.

Connie Thayer
(Typed or printed name of person mailing paper or fee)

Connie Thayer
(Signature of person mailing paper or fee)

12-29-99
(Date signed)

METHOD AND APPARATUS FOR WIRELESS
COMMUNICATION BETWEEN ELECTRONIC DEVICES

The present invention relates to communication systems and more

5 particularly to wireless communication between two devices that may operate on different frequency hopping protocols.

BACKGROUND

Electronic devices typically include one or more semiconductor chips that manipulate and control the flow of data by executing instructions that are either
10 entered by a user or read from a temporary, semi-permanent, or permanent storage area. These semiconductor chips are called processors. As the integration density of these processors increases, and the associated costs decrease, electronic devices will become increasingly pervasive in our society. Electronic devices include cellular and cordless phones, audio and video devices such as CD, DVD,
15 and VCR units, cable boxes, automobile accessories such as global positioning systems, and other types of computer systems from small handheld personal data assistants (PDAs), to notebook systems, to large workstations and servers.

Currently these electronic devices tend to operate on different communication protocols, making it difficult for one electronic device to communicate with another.

20 One reason why it might be found to be beneficial to have two different electronic devices communicate with one another is to quickly exchange data. For example, suppose a user has an address book electronically stored in a computer system, and the user wants to download the address book to their cellular phone so that names and numbers can be quickly called up and dialed from the phone. If the

computer system cannot communicate with the cellular phone, the user may need to resort to entering each name and number from their address book into their cellular phone by hand.

The present invention addresses this and other problems associated with the prior art.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, a first device operates at a first hopping frequency during a first period of time and operates at a second hopping frequency during a second period of time. A second device operates at the first hopping frequency and communicates with the first device during the first period of time. A third device operates at the second hopping frequency and communicates with the first device during the second period of time.

Other features and advantages of the present invention will be apparent from the accompanying figures and the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the accompanying figures in which like references indicate similar elements and in

which:

Figure 1 shows how three devices may communicate with each other using two different communication protocols in accordance with an embodiment of the present invention;

Figure 2 shows one implementation of the present invention in the home;

Figure 3 shows another implementation of the present invention in the home;

and

Figure 4 is a method of the present invention.

5

DETAILED DESCRIPTION

In accordance with an embodiment of the present invention, an electronic device is capable of operating at two different hopping frequencies. This electronic device is referred to herein as a "controller." Operation at the first hopping
10 frequency allows wireless communication between the controller and a first class of electronic devices in accordance with a first wireless communication protocol.

Operation at the second hopping frequency allows wireless communication between the controller and a second class of electronic devices in accordance with a second wireless communication protocol. The first wireless communication protocol
15 includes provisions to define a contention-free period during which time the first class of electronic devices do not communicate with the controller.

Initially, the controller operates at the first hopping frequency in accordance with the first wireless communication protocol, and communicates with a first electronic device belonging to the first class of electronic devices. The controller
20 detects the presence of a second electronic device belonging to the second class of electronic devices. The controller then determines a time frame for a contention-free period and indicates this time frame to the first device.

During the contention-free period, the first device ceases communication with the controller, and the controller operates at the second hopping frequency in accordance with the second wireless communication protocol. Communication between the controller and the second electronic device takes place. During this communication, data may be exchanged between the controller and the second electronic device, including an indication of the time frame for the next contention-free period.

After the contention-free period has ended, the controller again operates at the first hopping frequency in accordance with the first wireless communication protocol, and communicates with a first electronic device. This communication may continue until the next contention-free period.

In accordance with one embodiment of the present invention, the first wireless communication protocol may be the HomeRF* protocol described in the Shared Wireless Access Protocol (SWAP) Specification 1.0, released January 5, 1999. The second wireless communication protocol may be the Bluetooth* protocol described in the Bluetooth Specification, Version 1.0A, released July 24, 1999. Other communication protocols may be used, however. (*Trademarks and brands are the property of their respective owners.)

A more detailed description of embodiments of the present invention, including various configurations and implementations, is provided below.

Figure 1 shows how three devices may communicate with each other using two different communication protocols in accordance with an embodiment of the present invention. Time progresses from left to right in Figure 1. Solid vertical lines

represent frequency hops and dashed vertical lines are used to mark points in time to clarify the discussion below.

As used herein, a "block" is the period of time between frequency hops in accordance with a communication protocol. For example, Device B, of Figure 1, operates in accordance with a first protocol in which a single block lasts from time 101 to 111, and another block lasts from 111 to 121. Device C, of Figure 1, operates in accordance with a second protocol in which a block lasts for a much shorter period of time. Three blocks in accordance with the second protocol are labeled 100 in Figure 1. Various frequency hopping communication protocols may use alternate terms to refer to a block, such as frame, superframe, slot, or segment.

As used herein, a "hopping frequency" is the rate at which a device hops from one frequency to another in accordance with a communication protocol. As used herein, a "block frequency" is the operating frequency at which a device communicates within a block in accordance with a communication protocol. For example, HomeRF devices (i.e. devices able to communicate in accordance with the HomeRF communication protocol) operate at a hopping frequency of 50 hops per second, meaning each block lasts 20ms. Bluetooth devices (i.e. devices able to communicate in accordance with the Bluetooth communication protocol) operate at a hopping frequency of 1600 hops per second, meaning each block lasts 0.625ms. In accordance with both the HomeRF and Bluetooth protocols, each block frequency is in the vicinity of 2.4GHz.

Referring again to Figure 1, a first electronic device, Device A, is capable of operating at a first hopping frequency in accordance with a first communication

protocol during a first period of time, and at a second hopping frequency in accordance with a second communication protocol during a second period of time. During a first block bounded by times 101 and 111, Devices A and B operate at the same block frequency and may communicate with each other according to the first communication protocol. At time 111, both Devices A and B hop to the next block frequency in accordance with the first communication protocol. Then, during a second block bounded by times 111 and 121, Devices A and B operate at the same block frequency and may communicate with each other according to the first communication protocol.

Within the first block of the first communication protocol, bounded by times 101 and 111 of Figure 1, Device A switches to a second hopping frequency in accordance with the second communication protocol. During the period of time bounded by times 103 and 104, Devices A and C operate at the same hopping and block frequencies, and these devices may communicate with each other according to the second communication protocol. Within the next block of the first communication protocol, bounded by times 111 and 121 of Figure 1, Device A again switches to the second hopping frequency in accordance with the second communication protocol. During the period of time bounded by times 113 and 114, Devices A and C again operate at the same hopping and block frequencies, and these devices may communicate with each other according to the second communication protocol.

Note that in accordance with one embodiment of the present invention, Device A may be capable of switching to any number of hopping frequencies and

block frequencies to communicate with electronic devices in accordance with any number of communication protocols. In addition, for one embodiment, Device A may communicate with another electronic device that is also capable of switching to different hopping and block frequencies in accordance with different communication protocols. For this embodiment, the electronic devices may determine the proper protocol with which to communicate based on the particular electromagnetic environment in which the communication occurs, the type of data to be communicated between the devices, or based on user input.

In accordance with an embodiment of the present invention, coordination of communication between the electronic devices of Figure 1 may be controlled by Device A. For this reason, Device A may be referred to as a controller. For an embodiment of the present invention in which Device B is a HomeRF device and Device C is a Bluetooth device, Device A may be referred to as a connection point or master.

Devices A, B, and C may each include a receiver, a processor, and a transmitter. In accordance with one embodiment of the present invention, the same antenna may be used for both reception by a receiver and transmission by a transmitter. The processor may be used to process the signals received and sent. Examples of electronic devices that may be used to implement embodiments of the present invention are provided below in conjunction with Figures 2 and 3.

Device A, as the controller, listens for and receives a signal from Device C of Figure 1. This signal requests communication between Devices A and C and may be spontaneously sent from Device C (e.g. in regular, predetermined intervals) or it

may be sent in response to an initiating signal from Device A. This initiating signal may be occasionally sent from Device A to detect the presence of electronic devices with which to communicate. Note that for an embodiment in which Device C is a Bluetooth device, the signal from Device C requesting communication with Device A may be referred to as an inquiry.

After Device A of Figure 1 receives the signal from Device C requesting communication, Device A, as the controller, determines a time frame for a contention-free period. This determination may be made based on information contained in the signal received from Device C, the available bandwidth, and the communication protocols. For example, if Device C indicates that it requires lengthy communication as soon as possible with Device A, Device A may allocate more time for the contention-free period sooner after receiving the signal from Device C. If, however, Devices A and B are already engaged in communication of a large amount of data, then Device A may postpone or shorten the contention-free period.

Once determined, Device A of Figure 1 sends a signal to Device B indicating the time frame for the contention-free period. This signal may be sent during the period of time bounded by time 101 and 103, during which time Device A is operating according to the same communication protocol as Device B. In accordance with an embodiment in which this communication protocol is HomeRF, the signal sent from Device A to Device B indicating the time frame for the contention-free period may be referred to as a beacon.

According to Figure 1, the time frame for the first contention-free period begins at time 103 and ends at time 104. During this contention-free period,

communication between Device A and Device B is suspended. For one embodiment of the present invention, Device B, after receiving the signal from Device A indicating the time frame for the contention-free period, does not attempt to contend for communication with Device A during that period.

5 In accordance with various communication protocols, a contention-free period may alternatively be referred to as a time reservation or bandwidth reservation period. Provisions for establishing a contention-free period have been designed into wireless communication protocols, such as HomeRF, to provide guaranteed bandwidth to electronic devices that require time-critical communication, such as
10 cordless phones. In accordance with an embodiment of the present invention, these provisions may be used to reserve a time period during which electronic devices may communicate using alternate communication protocols.

At time 103 of Figure 1, both Device A and Device C hop to the same block frequency and begin the process of establishing a communication link between the
15 devices. For an embodiment in which Device C is a Bluetooth device that communicates with Device A during the contention-free period in accordance with the Bluetooth communication protocol, this process of establishing a communication link may be referred to as paging. In addition, for this embodiment, Device A establishes itself as the master device and Device C operates as the slave.

20 As shown in Figure 1, during the contention-free period from time 103 to 104, Devices A and C communicate with each other over the course of eight frames in accordance with the same frequency hopping communication protocol. During this time, Device A may send a signal to Device C indicating the time frame and initial

block frequency for the start of the next contention-free period at time 113. Device C may then wait until time 113 before re-establishing communication with Device A.

At time 104 of Figure 1, Device A hops back to the block frequency at which Device B is operating, again allowing Devices A and B to communicate with each other according to their mutual communication protocol. Both Devices A and B hop to the next block frequency at time 111, and the process continues in the manner described above. For example, Devices A and B may communicate according to a first communication protocol within the block during the period of time outside the contention-free period. That is from time 111 to 113 and from time 114 to 121. The time period from 113 to 114 is reserved as the contention free period during which time Device B halts communication with Device A, and Devices A and C communicate according to a second communication protocol over the course of twelve blocks.

For one embodiment of the present invention, Devices A, B, and C of Figure 1 may be any type of electronic device including, for example, a cell phone, cordless phone, set top box, desktop or mobile computer, automobile, etc. For example, Figure 2 shows one implementation of the present invention in the home. Set top box 201 is coupled to a cable 210 that provides high bandwidth communication with a local cable provider. Set top box 201 may wirelessly communicate with cordless phone 203 according to a first communication protocol operating at a first hopping frequency. Set top box 201 may simultaneously wirelessly communicate with cell phone 202 according to a second communication protocol operating at a second hopping frequency according to the method described above.

For the example of Figure 2, set top box 201 acts as the controller (e.g., Device A of Figure 1). In accordance with this example, a user may be able to talk on cordless phone 203 while downloading data from set top box 201 to cell phone 202. This data may include, for example, an electronic address book or email.

5 As another example, Figure 3 shows another implementation of the present invention in the home. Set top box 301 is coupled to a cable 310 that provides high bandwidth communication with a local cable provider. Set top box 301 may wirelessly communicate with computer 303 according to a first communication protocol operating at a first hopping frequency. Computer 303 may simultaneously
10 wirelessly communicate with cell phone 302 according to a second communication protocol operating at a second hopping frequency according to the method described above.

For the example of Figure 3, computer 303 acts as the controller (e.g., Device A of Figure 1). In accordance with this example, a user may be able to surf the
15 internet from computer 303 using set top box 301 as a cable modem while downloading data from computer 303 to cell phone 302. This data may include, for example, an electronic address book or email.

Figure 4 is a method of the present invention as implemented from the perspective of the controller communicating with a second device at a second
20 hopping frequency when a first device operating at a first hopping frequency is detected in the wireless network. Figure 4 describes the steps that may be taken at each block of the slower hopping frequency (which is the second hopping frequency in the example of Figure 4). Note that the method of Figure 4 may be implemented

by a computer system programmed to execute the steps of the method. Such a program may reside on any computer readable medium such as a magnetic disk (e.g. a hard drive or floppy), an optical disk (e.g. a CD or DVD), or a semiconductor device (e.g. Flash, EPROM, or RAM).

5 At step 405 of Figure 4 a first signal is received from a first electronic device operating at a first hopping frequency. At step 410 it is determined whether or not the first signal indicates that the first device desires communication with the controller. If communication is not desired, or communication is not possible or convenient, then the second device communicates with the controller at the second
10 hopping frequency at step 425. If, however, the first signal indicates that communication between the first electronic device and the controller is desired, then the method proceeds to step 415.

 At step 415 of Figure 4, a time frame for a contention-free period is determined. The information containing this time frame is sent to a second
15 electronic device operating at a second hopping frequency to indicate the contention-free period to the second device. During the contention-free period at step 420, the first device communicates with the controller at the first hopping frequency, and outside the contention-free period at step 425, the second device communicates with the controller at the second hopping frequency.

20 This invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident to persons having the benefit of this disclosure that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the invention.

The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

CLAIMS

What is claimed is:

- 1 1. A method of communicating between electronic devices comprising:
2 operating a first device at a first hopping frequency during a first period of
3 time and at a second hopping frequency during a second period of
4 time;
5 operating a second device at the first hopping frequency, the second
6 device communicating with the first device during the first period of
7 time; and
8 operating a third device at the second hopping frequency, the third device
9 communicating with the first device during the second period of time.
- 1 2. The method of claim 1, wherein the second and third devices communicate
2 with the first device during the first and second periods of time, respectively,
3 within a single block
- 1 3. The method of claim 2, wherein the third device communicates with the first
2 device during a contention-free period.
- 1 4. The method of claim 3, wherein the second device communicates with the
2 first device outside of the contention-free period.

1 5. The method of claim 1, wherein the third device communicates with the first
2 device during a contention-free period.

1 6. The method of claim 5, wherein the second device communicates with the
2 first device outside of the contention-free period.

1 7. The method of claim 1 further comprising:
2 sending a signal from the third device to the first device, the signal
3 requesting communication with the first device; and
4 determining a time frame for the second period of time in response to
5 receiving the signal.

1 8. The method of claim 7, further comprising indicating the time frame to the
2 second device.

1 9. The method of claim 1, wherein the third device communicates with the first
2 device during a contention-free period, and the second device communicates
3 with the first device outside of the contention-free period.

1 10. A method of wirelessly communicating with electronic devices comprising:
2 receiving a first signal from a first device operating at a first hopping
3 frequency;

4 sending a second signal to a second device operating at a second
5 hopping frequency in response to receiving the first signal, the second
6 signal indicating a time frame for a contention-free period; and
7 communicating with the first device at the first hopping frequency during
8 the contention-free period.

1 11. The method of claim 10, further comprising communicating with the second
2 device outside of the contention-free period.

1 12. The method of claim 10, wherein sending the second signal to the second
2 device and communicating with the first device are done within a single block.

1 13. The method of claim 10, further comprising sending an initiating signal to the
2 first device to detect its presence, and the first signal is sent in response to
3 the initiating signal.

1 14. The method of claim 10, wherein communication with the first device is done
2 within the same block in which the second signal is sent

1 15. The method of claim 10, wherein the first device is a Bluetooth device and the
2 second device is a HomeRF device.

1 16. A computer system programmed to implement the method of claim 10.

1 17. An electronic device comprising:

2 a receiver to detect a first signal from a first device operating at a first

3 hopping frequency;

4 a processor to determine a time frame for a contention-free period;

5 a transmitter to send a second signal to a second device operating at a

6 second hopping frequency in response to detecting the first signal, the

7 second signal to indicate the time frame for the contention-free period,

8 the transmitter to further communicate with the first device at the first

9 hopping frequency during the contention-free period.

1 18. The device of claim 17, wherein the first device is a Bluetooth device.

1 19. The device of claim 18, wherein the second device is a HomeRF device.

1 20. The device of claim 17, wherein the second device is a HomeRF device.

1 21. The device of claim 17, wherein the electronic device is a computer system.

1 22. A computer readable medium having stored thereon a set of instructions that,
2 when executed by a computer, cause the computer to:

3 receive a first signal from a first device operating at a first hopping

4 frequency;

ABSTRACT OF THE DISCLOSURE

A first device operates at a first hopping frequency during a first period of time and operates at a second hopping frequency during a second period of time. A second device operates at the first hopping frequency and communicates with the first device during the first period of time. A third device operates at the second hopping frequency and communicates with the first device during the second period of time. The second period of time may be a contention-free period during which time the second device may not communicate with the first device.

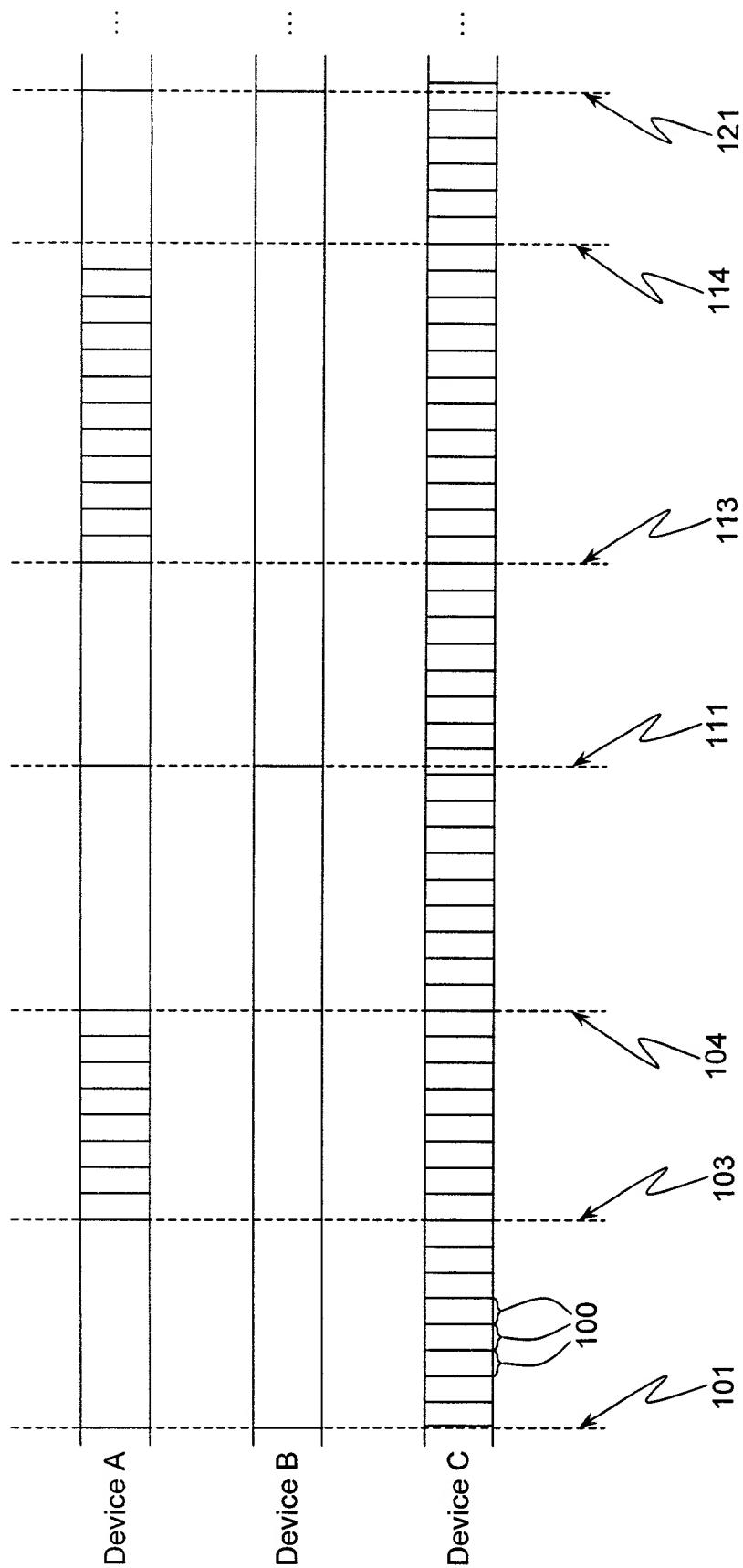


Figure 1

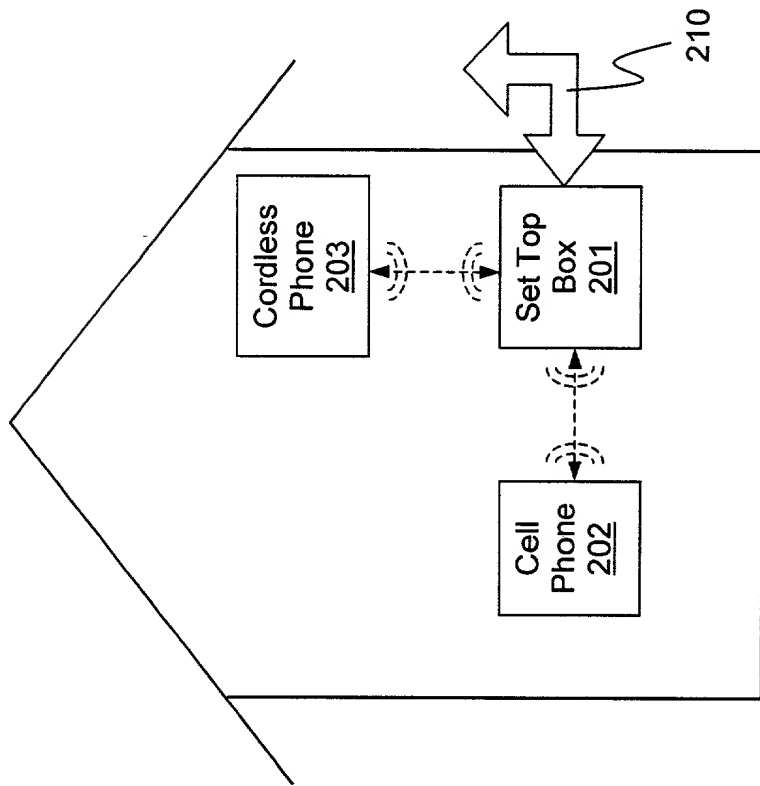


Figure 2

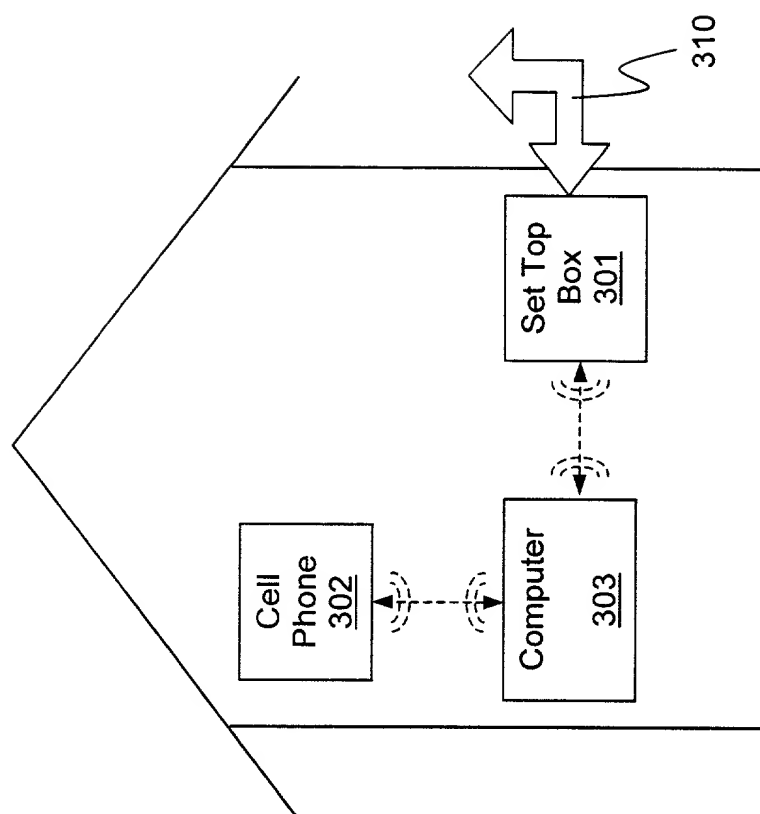


Figure 3

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR WIRELESS COMMUNICATION BETWEEN ELECTRONIC DEVICES

the specification of which

X is attached hereto.
— was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____.

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed</u>	
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date
(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

I hereby appoint Farzad E. Amini, Reg. No. P42,261; Aloysius T. C. AuYeung, Reg. No. 35,432; Amy M. Armstrong, Reg. No. 42,265; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; Gregory D. Caldwell, Reg. No. 39,926; Kent M. Chen, Reg. No. 39,630; Lawrence M. Cho, Reg. No. 39,942; Yong S. Choi, Reg. No. P43,324; Thomas M. Coester, Reg. No. 39,637; Roland B. Cortes, Reg. No. 39,152; Barbara Bokanov Courtney, Reg. No. 42,442; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Robert Andrew Diehl, Reg. No. 40,992; Tarek N. Fahmi, Reg. No. 41,402; James Y. Go, Reg. No. 40,621; Richard Leon Gregory, Jr., Reg. No. 42,607; Dinu Gruia, Reg. No. P42,996; David R. Halvorson, Reg. No. 33,395; Thomas A. Hassing, Reg. No. 36,159; Phuong-Quan Hoang, Reg. No. 41,839; Willmore F. Holbrow III, Reg. No. P41,845; George W. Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; Dag H. Johansen, Reg. No. 36,172; William W. Kidd, Reg. No. 31,772; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, under 37 C.F.R. § 10.9(b); Paul A. Mendonsa, Reg. No. 42,879; Darren J. Milliken, Reg. No. 42,004; Thinh V. Nguyen, Reg. No. 42,034; Kimberley G. Nobles, Reg. No. 38,255; Michael A. Proksch, Reg. No. 43,021; Babak Redjaian, Reg. No. 42,096; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Anand Sethuraman, Reg. No. P43,351; Charles E. Shemwell, Reg. No. 40,171; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Allan T. Sponseller, Reg. No. 38,318; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; George G. C. Tseng, Reg. No. 41,355; Lester J. Vincent, Reg. No. 31,460; John Patrick Ward, Reg. No. 40,216; Stephen Warhola, Reg. No. 43,237; Charles T. J. Weigell, Reg. No. 43,398; Ben J. Yorks, Reg. No. 33,609; and Norman Zafman, Reg. No. 26,250; my attorneys, and James A. Henry, Reg. No. 41,064; Daniel E. Ovanezian, Reg. No. 41,236; Glenn E. Von Tersch, Reg. No. 41,364; and Chad R. Walsh, Reg. No. 43,235; my patent agents, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (310) 207-3800, and James R. Thein, Reg. No. 31,710, my patent attorney; with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to David J. Kaplan, BLAKELY, SOKOLOFF, TAYLOR &
(Name of Attorney or Agent)
ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct
telephone calls to David J. Kaplan, (408) 720-8598.
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all
statements made on information and belief are believed to be true; and further that these
statements were made with the knowledge that willful false statements and the like so made are
punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States
Code and that such willful false statements may jeopardize the validity of the application or any
patent issued thereon.

Full Name of Sole/First Inventor James L. Lansford

Inventor's Signature _____ Date _____

Residence Stillwater, Oregon Citizenship U.S.A.
(City, State) (Country)

Post Office Address 6605 Coventry Drive
Stillwater, Oregon 74074

Full Name of Second/Joint Inventor Jon W.T. Inouye

Inventor's Signature JWT Inouye Date 12/14/99

Residence Chandler, Arizona Citizenship U.S.A.
(City, State) (Country)

Post Office Address 411 North Kyrene Road, #219
Chandler, Arizona 85226

Full Name of Third/Joint Inventor Debashis Chowdhury

Inventor's Signature Debashis Chowdhury Date 12/15/99

Residence Chandler, Arizona Citizenship U.S.A.
(City, State) (Country)

Post Office Address 6160 West Park Avenue
Chandler, Arizona 85226

Full Name of Fourth/Joint Inventor _____

Inventor's Signature _____ Date _____

Residence _____ Citizenship _____
(City, State) (Country)

Post Office Address _____

Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) Prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
 - (2) Each attorney or agent who prepares or prosecutes the application; and
 - (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.